

What is Claimed is:

1. A circuit for controlling a power converter that delivers output current to an output capacitor at an output voltage, the power converter (1) having an inductor and a switch circuit with one or more active switch elements and (2) configured to be coupled to a user-programmable filter, the circuit comprising:

a first control circuit that continuously adjusts current flowing through the inductor in a first operational mode; and

a second control circuit that commands all of the one or more active switch elements to be maintained OFF during at least part of a second operational mode, the second control circuit configured to monitor the output current and transition the power converter from the first operational mode to the second operational mode after an average signal crosses a first user-programmable mode transition threshold, the second operational mode having a duration that is responsive to a decrease in load current demand, wherein the monitored output current is averaged to generate the average signal.

2. The circuit of claim 1, wherein at least one of the one or more active switch elements is turned ON during the second operational mode responsive to the output voltage falling below a WAKE threshold.

3. The circuit of claim 1, wherein the second control circuit further comprises an under-voltage comparator configured to permit transition of the power converter from the second operational mode to the first

operational mode responsive to the output voltage falling below an under-voltage mode transition threshold.

4. The circuit of claim 3, wherein at least one of the one or more active switch elements is turned ON during the second operational mode responsive to the output voltage falling below a WAKE threshold that is greater than the under-voltage mode transition threshold.

5. The circuit of claim 3, wherein the second control circuit further comprises a switch that selectively couples the user-programmable filter to a power source responsive to the output voltage falling below the under-voltage mode transition threshold, thereby permitting the power source to recharge the user-programmable filter.

6. The circuit of claim 1, wherein the second operational mode spans more than one switch circuit cycle.

7. The circuit of claim 1, wherein the second control circuit is configured to transition the power converter from the second operational mode to the first operational mode after the average signal crosses a second user-programmable mode transition threshold.

8. The circuit of claim 7, wherein the second user-programmable mode transition threshold is greater than the first user-programmable mode transition threshold.

9. The circuit of claim 1, wherein the first user-programmable mode transition threshold is programmed by a programming resistance.

10. The circuit of claim 1, wherein the second control circuit comprises a transistor configured to monitor a fraction of the output current.

11. The circuit of claim 1, further comprising a compensation network having at least a compensation capacitor.

12. The circuit of claim 11, further comprising a switch configured to decouple the compensation network from the first and second control circuits when the power converter is in the second operational mode and to couple the compensation network to the first and second control circuits when the power converter is in the first operational mode.

13. The circuit of claim 11, further comprising a clamp configured to clamp a voltage on the compensation capacitor when the power converter is in the second operational mode.

14. The circuit of claim 1, wherein a duty cycle of the switch circuit is voltage-mode controlled.

15. The circuit of claim 1, wherein a duty cycle of the switch circuit is current-mode controlled.

16. The circuit of claim 1, wherein the first operational mode is configured for 4-phase operation.

17. The circuit of claim 16, wherein three of the four phases are configured to be reversibly deactivated during the second operational mode.

18. The circuit of claim 1, wherein the second control circuit is configured to permit a user to force the power converter to operate in the first operational mode or the second operational mode.

19. A circuit for controlling a power converter that delivers output current to an output capacitor at an output voltage, the power converter (1) having an inductor and a switch circuit with one or more active switch elements and (2) configured to be coupled to a user-programmable filter, the circuit comprising:

a first control circuit that continuously adjusts current flowing through the inductor in a first operational mode; and

a second control circuit that monitors the output current and transitions the power converter from the first operational mode into a low power consumption mode after an average signal crosses a first user-programmable mode transition threshold, the low power consumption mode having a duration that is responsive to a decrease in load current demand, wherein the monitored output current is averaged to generate the average signal.

20. A circuit for controlling a power converter that delivers output current to an output capacitor at an output voltage, the circuit comprising:

a current mirror that monitors the output current; and

a comparator that commands transition of the power converter into a low power consumption mode after an average signal crosses a first user-programmable mode transition threshold, the low power consumption mode having a duration that is responsive to a decrease in load current demand, wherein the monitored output current is averaged to generate the average signal.

21. A power converter that delivers output current to an output capacitor at an output voltage, the power converter having an inductor and a switch circuit with one or more active switch elements and a first control circuit that continuously adjusts current flowing through the inductor in a first operational mode, the power converter comprising:

a second control circuit that monitors the output current and transitions the power converter from the first operational mode into a low power consumption mode after an average signal crosses a first user-programmable mode transition threshold, the low power consumption mode having a duration that is responsive to a decrease in load current demand; and

a filter that averages the monitored output current to generate the average signal.

22. A method for controlling a power converter (1) having an inductor and a switch circuit with one or more active switch elements and (2) configured to be coupled to a user-programmable filter,

the power converter configured to deliver output current to an output capacitor at an output voltage, the method comprising:

monitoring the output current;

averaging the monitored output current to generate an average signal;

continuously adjusting current flowing through the inductor in a first operational mode;

transitioning the power converter from the first operational mode to a second operational mode after the average signal crosses a first user-programmable mode transition threshold;

maintaining all of the one or more active switch elements OFF during at least part of the second operational mode; and

maintaining the power converter in the second operational mode for a duration that is responsive to a decrease in load current demand.

23. The method of claim 22, further comprising turning at least one of the one or more active switch elements ON during the second operational mode responsive to the output voltage falling below a WAKE threshold.

24. The method of claim 22, further comprising transitioning the power converter from the second operational mode to the first operational mode responsive to the output voltage falling below an under-voltage mode transition threshold.

25. The method of claim 24, further comprising turning at least one of the one or more active switch elements ON during the second operational mode responsive to the output voltage falling below a WAKE threshold that is greater than the under-voltage mode transition threshold.

26. The method of claim 24, further comprising:

selectively coupling the user-programmable filter to a power source responsive to the output voltage falling below the under-voltage mode transition threshold; and

recharging the user-programmable filter.

27. The method of claim 22, further comprising transitioning the power converter from the second operational mode to the first operational mode responsive to the average signal crossing a second user-programmable mode transition threshold.

28. The method of claim 27, wherein the second user-programmable mode transition threshold is greater than the first user-programmable mode transition threshold.

29. The method of claim 22, further comprising programming the first user-programmable mode transition threshold with a programming resistance.

30. The method of claim 22, wherein monitoring the output current comprises monitoring a fraction of the output current through a transistor.

31. The method of claim 22, further comprising providing frequency compensation with a compensation network having at least a compensation capacitor.

32. The method of claim 31, further comprising reducing discharge of the compensation capacitor when the power converter is in the second operational mode.

33. The method of claim 22, further comprising controlling a duty cycle of the switch circuit with voltage-mode control.

34. The method of claim 22, further comprising controlling a duty cycle of the switch circuit with current-mode control.

35. The method of claim 22, wherein the first operational mode is configured for 4-phase operation, the method further comprising reversibly deactivating three of the four phases during the second operational mode.

36. A method for controlling a power converter coupled to an inductor and a switch circuit having one or more active switch elements, the power converter configured to deliver output current to an output capacitor at an output voltage, the method comprising:

monitoring the output current;

averaging the monitored output current to generate an average signal;

continuously adjusting current flowing through the inductor in a first operational mode;

transitioning the power converter from the first operational mode to a low power consumption mode after the average signal crosses a first user-programmable mode transition threshold; and

maintaining the power converter in the low power consumption mode for a duration that is responsive to a decrease in load current demand.